**Introduction**

Approximately two-thirds of the college-bound students in the Spokane region begin their post-secondary education at Spokane Falls Community College (SFCC), Spokane Community College (SCC), or Eastern Washington University (EWU). As a group of mathematics educators and leaders at secondary and post-secondary institutions in the area, the Spokane Regional Math Council (SRMC) is interested in improving student success as students transition from their high school math courses to the mathematics required in their vocational programs or college courses.

The Gap Analysis uses the Common Core State Standards to support alignment between secondary and post-secondary mathematics courses. The results will be used to initiate discussions between high school mathematics teachers, college math faculty, and leaders in the Spokane area about the mathematics that students are expected to learn as they progress through Spokane-area high schools and colleges. Through this collaboration, we hope to support smoother transitions from high school to college for students in the Spokane area and share ideas for best practices in teaching and learning mathematics.

The Core to College collaboration in the Spokane area is coordinated by SFCC and includes a consortium of SFCC, SCC, Spokane Public Schools (SPS), Northeast Washington Educational Service District (NEWESD 101), and EWU.

**Background**

This project is funded by a **Core to College** grant, a multi-state grant program intended to foster long-term collaborations between state higher education and K-12 entities that will improve student college readiness and increase rates of enrollment and graduation using the [Common Core State Standards](http://www.corestandards.org/) (CCSS) and assessments. Funding for Core to College is provided by the [Lumina Foundation](http://www.luminafoundation.org), the [William and Flora Hewlett Foundation](http://www.hewlett.org) and the [Bill & Melinda Gates Foundation](http://www.gatesfoundation.org).

Core to College is one of several current and previous initiatives in the Spokane area focused on improving students’ transition from high school to college mathematics. Other collaborations include the Annual Math Symposium, Affinity Network (also includes WSU), College Spark (CCS and SPS), and the Riverpoint Advanced Mathematics Partnership – Algebra (RAMP-A: includes WSU). Previous collaborations include the Transition Mathematics Project (TMP) and Riverpoint Advanced Mathematics Partnership (RAMP: included WSU).

**Next Steps**

Several secondary and post-secondary institutions in the Spokane area will complete the Gap Analysis for their programs in the spring of 2013. The results will be summarized in the summer of 2013, and shared in the fall of 2013 with all the institutions that participated.

**Directions**

* Complete Part 1, the Program Reporting Sheet, to provide a snapshot of the program and contact information at your institution.
* Complete Part 2, Course Ratings, to indicate the level that each standard is addressed within each course. As you read each standard, note that the language of the domain and cluster also play a role in interpreting the full meaning of the standard statement.1
* Complete Part 3: Course ratings on Standards for Mathematics Practices.
* Complete Part 4: Your questions and comments on the process of using this tool.

1Note: your course may include many standards that are not described within this document. This tool only compares programs on the content and practices of the Algebra and Function conceptual categories of the CCSS while many math programs also include learning goals from the other conceptual categories: Number and Quantity, Geometry, and Statistics and Probability, and from standards now found in the middle school content standards.

**Part 1: Program Reporting Sheet:**

Courses should be listed in the order that students typically take them. If your institution has more than six courses in the sequence below Calculus, add a column in the table for each additional course.

Provide a title for each course, a brief description of the content of the course, a brief description of students taking the course, and published curricular materials if those materials are used extensively in the course. Include the name(s) and contact information of the person(s) completing the Gap Analysis for each course. Also, include the name and contact information for the person at your institution who can be contacted for further discussions. See the sample row below for ideas of how to complete the descriptions.

Sample row in the Program Reporting Sheet:

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| **Course 3** | Algebra Concepts | Introduces selected algebra topics with in-depth implementation of graphing and mathematical reasoning. Algebra topics include linear, quadratic, and exponential functions, piece-wise defined functions, and absolute value equations and functions. | Students who have completed Basic Algebra for College Students with at least a 3.0 or Intermediate Algebra with at least a 2.0, and who intend to pursue a math-intensive major. Students may also place into this course by earning 150-155 on the APTP General test. | *College Algebra: Concepts and Contexts,* by Stewart, Redlin, Watson, and Panman | Jackie Coomes, Course Coordinator  (jcoomes@ewu.edu) |

**Program Reporting Sheet**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Institution:** | | | | | |
| **Primary Contact Person:** | | | | | |
| **Course #** | **Course Title** | **Course Description** | **Student Description** | **Curricular Materials** | **Contact Person/Role** |
| **Course 1** |  |  |  |  |  |
| **Course 2** |  |  |  |  |  |
| **Course 3** |  |  |  |  |  |
| **Course 4** |  |  |  |  |  |
| **Course 5** |  |  |  |  |  |
| **Course 6** |  |  |  |  |  |

**Part 2: Rate each standard according to its intended focus in each course.**

**Refer to the following Characteristics of CCSS as you consider the rating descriptions on the rubric (McCallum, 2012)**. Note also that the domain and cluster statements are meant to provide additional insight into the meanings of the standards. The next page contains examples of ratings and rationales for those ratings.

**Focus** means attending to *fewer topics in* *greater depth* at any given grade level.

**Coherence** means attending to the structure of mathematics and the natural pathways through that structure, where “natural" means taking into account both the imperatives of logic and the imperatives of cognitive development in designing the sequence of ideas. Teaching with coherence supports students’ sense-making of the mathematical ideas.

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| **N (No)** This standard is **Not** addressed or used in this course. | **P (Prerequisite**) Students are expected to be able to apply this standard fluently in this course, but it is not taught in this course. | **B (Brief)** This standard is addressed in this course but only briefly or only procedurally. | **M (Moderate)**: This standard is addressed in this course more than briefly but *not* with all three characteristics: procedural fluency, conceptual understanding, and meaningful applications; or contains all three but lacks connections between procedural fluency and conceptual understanding. | **H (High):** This standard is a major *focus* of this course, and students have opportunities to learn with *rigor* (conceptual understanding, procedural fluency, and meaningful applications.) Strong connections are made between conceptual understanding and procedural fluency. |

**Rigor** means balancing conceptual understanding, procedural fluency, and meaningful applications of mathematics. Here the word rigor is used not in the way that mathematicians use it, to indicate a correct and complete chain of logical reasoning, but in the sense of a rigorous preparation for a sport or profession: one that exercises all the necessary proficiencies in a balanced way.

**Example ratings (all examples come from Math 114 at EWU Algebra Concepts):**

**Rated N (Not used): (A-SSE.4)**

**[Domain:** Seeing Structure in Expressions; **Cluster:** Write expressions in equivalent forms to solve problems.

4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.]

**Rationale:** This standard is beyond the scope of the course.

**Rated P (Prerequisite): (A-REI.6)**

**[Domain:** Reasoning with Equations and Inequalities; **Cluster**: Understand solving equations as a process of reasoning and explain the reasoning: 6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.]

**Rationale:** Students are expected to be able to solve a system of linear equations when it is necessary to do so, but it is not taught explicitly in this course.

**Rated B (Brief**)**: (A-SSE.2)**

[**Domain:** Seeing Structure in Expressions; **Cluster:** Interpret the structure of expressions: 2. Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).]

**Rationale:** We ask students to be able to factor (without expanding first) expressions such as , , and , however, we do not spend much time on these, nor do we ask them to understand conceptually or in a context.

**Rated M (Moderate): (A-REI.1)**

**[Domain:** Reasoning with Equations and Inequalities; **Cluster**: Understand solving equations as a process of reasoning and explain the reasoning. 1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.]

**Rationale:** Students are asked to understand the reasoning associated with solving quadratic equations. This is done in a way that connects procedures with concepts. However, we did not rate this as High since we do not address the reasoning involved in solving equations with meaningful applications.

**Rated H (High**): (A-SSE.3a and b)

[**Domain:** Seeing Structure in Expressions; **Cluster:** Write expressions in equivalent forms to solve problems. 3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★

a. Factor a quadratic expression to reveal the zeros of the function it defines; b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.]

**Rationale:** This is a major focus of the course. Students are expected to factor quadratic expressions, use the factored form of expressions that define functions to find x-intercepts and describe meanings of zeros of quadratic functions in terms of contexts. They are expected to use the x-intercepts from the graphs of the quadratic functions to find equations for functions. They are expected to complete the square of a quadratic function and use the vertex form to graph the function. They are also expected to use these ideas in contexts.

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| **Standards** | **Course 1** | **Course 2** | **Course 3** | **Course 4** | **Course 5** | **Course**  **6** |
| **Conceptual Category: Algebra** | | | | | | |
| **Domain:** Seeing Structure in Expressions (A-SSE); **Cluster:** Interpret the structure of expressions | | | | | | |
| 1. Interpret expressions that represent a quantity in terms of its context.  a. Interpret parts of an expression, such as terms, factors, and coefficients.  b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)n as the product of P and a factor not depending on P. |  |  |  |  |  |  |
| 2. Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2). |  |  |  |  |  |  |
| **Domain:** Seeing Structure in Expressions (A-SSE); **Cluster:** Write expressions in equivalent forms to solve problems | | | | | | |
| 3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★  a. Factor a quadratic expression to reveal the zeros of the function it defines.  b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.  c. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as (1.151/12)12t ≈ 1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%. |  |  |  |  |  |  |
| 4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments. |  |  |  |  |  |  |
| **Domain:** Arithmetic with Polynomials and Rational Expressions (A –APR); **Cluster**: Perform arithmetic operations on polynomials | | | | | | |
| 1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. |  |  |  |  |  |  |
| **Domain:** Arithmetic with Polynomials and Rational Expressions (A –APR); **Cluster**: Understand the relationship between zeros and factors of polynomials | | | | | | |
| 2. Know and apply the Remainder Theorem: For a polynomial **p**(**x**) and a number **a**, the remainder on division by **x** – **a** is **p**(**a**), so **p**(**a**) = 0 if and only if (**x** – **a**) is a factor of **p**(**x**). |  |  |  |  |  |  |
| 3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. |  |  |  |  |  |  |
| **Domain:** Arithmetic with Polynomials and Rational Expressions (A –APR); **Cluster:** Use polynomial identities to solve problems | | | | | | |
| 4. Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity (x2 + y2)2 =  (x2 – y2)2 + (2xy)2 can be used to generate Pythagorean triples. |  |  |  |  |  |  |
| 5. Know and apply the Binomial Theorem for the expansion of  (x + y)n in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal’s Triangle. |  |  |  |  |  |  |
| **Domain:** Arithmetic with Polynomials and Rational Expressions (A –APR); **Cluster:** Rewrite rational expressions | | | | | | |
| 6. Rewrite simple rational expressions in different forms; write **a**(**x**)/**b**(**x**) in the form **q**(**x**) + **r**(**x**)/**b**(**x**), where **a**(**x**), **b**(**x**), **q**(**x**), and **r**(**x**) are polynomials with the degree of **r**(**x**) less than the degree of **b**(**x**), using inspection, long division, or, for the more complicated examples, a computer algebra system. |  |  |  |  |  |  |
| 7. Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. |  |  |  |  |  |  |
| **Domain:** Creating Equations (A –CED); **Cluster**: Create equations that describe numbers or relationships. | | | | | | |
| 1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. |  |  |  |  |  |  |
| 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. |  |  |  |  |  |  |
| 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. |  |  |  |  |  |  |
| 4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm’s law V = IR to highlight resistance R. |  |  |  |  |  |  |
| **Domain:** Reasoning with Equations and Inequalities (A –REI); **Cluster**: Understand solving equations as a process of reasoning and explain the reasoning. | | | | | | |
| 1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. |  |  |  |  |  |  |
| 2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. |  |  |  |  |  |  |
| **Domain:** Reasoning with Equations and Inequalities (A –REI); **Cluster:** Solve equations and inequalities in one variable | | | | | | |
| 3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. |  |  |  |  |  |  |
| 4. Solve quadratic equations in one variable.  a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x – p)2 = q that has the same solutions. Derive the quadratic formula from this form.  b. Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  a ± bi for real numbers a and b. |  |  |  |  |  |  |
| **Domain:** Reasoning with Equations and Inequalities (A –REI); **Cluster:** Solve systems of equations. | | | | | | |
| 5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. |  |  |  |  |  |  |
| 6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. |  |  |  |  |  |  |
| 7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line  y = –3x and the circle x2 + y2 = 3. |  |  |  |  |  |  |
| 8. Represent a system of linear equations as a single matrix equation in a vector variable. |  |  |  |  |  |  |
| 9. Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater). |  |  |  |  |  |  |
| **Domain:** Reasoning with Equations and Inequalities (A -REI)**; Cluster:** Represent and solve equations and inequalities graphically | | | | | | |
| 10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). |  |  |  |  |  |  |
| 11. Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation  f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where **f**(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. |  |  |  |  |  |  |
| 12. Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. |  |  |  |  |  |  |

**Functions**

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| --- | --- | --- | --- | --- | --- | --- |
| **Standards** | **Course 1** | **Course 2** | **Course 3** | **Course 4** | **Course 5** | **Course 6** |
| **Conceptual Category: Functions** | | | | | | |
| **Domain:** Interpreting Functions (F-IF); **Cluster:** Understand the concept of a function and use function notation. | | | | | | |
| 1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x). |  |  |  |  |  |  |
| 2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. |  |  |  |  |  |  |
| 3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1,  f(n+1) = f(n) + f(n-1) for n ≥ 1. |  |  |  |  |  |  |
| **Domain:** Interpreting Functions (F-IF); **Cluster:** Interpret functions that arise in applications in terms of the context | | | | | | |
| 4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.★ |  |  |  |  |  |  |
| 5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function. |  |  |  |  |  |  |
| 6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.  Estimate the rate of change from a graph. |  |  |  |  |  |  |
| **Domain:** Interpreting Functions (F-IF); **Cluster:** Analyze functions using different representations. | | | | | | |
| 7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★  a. Graph linear and quadratic functions and show intercepts, maxima, and minima.  b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.  c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.  d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.  e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. |  |  |  |  |  |  |
| 8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.  a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.  b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t,  y = (1.2)t/10, and classify them as representing exponential growth or decay. |  |  |  |  |  |  |
| 9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum. |  |  |  |  |  |  |
| **Domain:** Building Functions (F-BF); **Cluster:** Build a function that models a relationship between two quantities. | | | | | | |
| 1. Write a function that describes a relationship between two quantities.★  a. Determine an explicit expression, a recursive process, or steps for calculation from a context.  b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.  c. (+) Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time. |  |  |  |  |  |  |
| 2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. |  |  |  |  |  |  |
| **Domain:** Building Functions (F-BF); **Cluster:** Build new functions from existing functions. | | | | | | |
| 3. Identify the effect on the graph of replacing **f**(**x**) by **f**(**x**) + **k**, **k f**(**x**),  **f**(**kx**), and **f**(**x** + **k**) for specific values of **k** (both positive and negative); find the value of **k** given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. |  |  |  |  |  |  |
| 4. Find inverse functions.  a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. **For** **example, f(x) =2 x3 or f(x) = (x+1)/(x–1) for x** ≠ **1.**  b. (+) Verify by composition that one function is the inverse of another.  c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.  d. (+) Produce an invertible function from a non-invertible function by restricting the domain. |  |  |  |  |  |  |
| 5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. |  |  |  |  |  |  |
| **Domain:** Linear, Quadratic, and Exponential Models★ (F –LE); **Cluster:** Construct and compare linear, quadratic, and exponential models and solve problems. | | | | | | |
| 1. Distinguish between situations that can be modeled with linear functions and with exponential functions.  a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.  b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.  c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. |  |  |  |  |  |  |
| 2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). |  |  |  |  |  |  |
| 3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. |  |  |  |  |  |  |
| 4. For exponential models, express as a logarithm the solution to  abct = d where a, c, and d are numbers and the base b is 2, 10, or e;  evaluate the logarithm using technology. |  |  |  |  |  |  |
| **Domain:** Linear, Quadratic, and Exponential Models★ (F –LE); **Cluster**: Interpret expressions for functions in terms of the situation they model. | | | | | | |
| 5. Interpret the parameters in a linear or exponential function in terms of a context. |  |  |  |  |  |  |
| **Domain:** Trigonometric Functions (F-TF); **Cluster**: Extend the domain of trigonometric functions using the unit circle. | | | | | | |
| 1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. |  |  |  |  |  |  |
| 2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. |  |  |  |  |  |  |
| 3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for **π**/3, **π**/4 and **π**/6, and use the unit circle to express the values of sine, cosine, and tangent for **π**–**x**, **π**+**x**, and 2**π**–**x** in terms of their values for **x**, where **x** is any real number. |  |  |  |  |  |  |
| 4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions. |  |  |  |  |  |  |
| **Domain** Trigonometric Functions (F-TF); **Cluster:** Model periodic phenomena with trigonometric functions | | | | | | |
| 5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.**★** |  |  |  |  |  |  |
| 6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed. |  |  |  |  |  |  |
| 7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.**★** |  |  |  |  |  |  |
| **Domain:** Trigonometric Functions (F-TF); **Cluster:** Prove and apply trigonometric identities. | | | | | | |
| 8. Prove the Pythagorean identity sin2(**θ**) + cos2(**θ**) = 1 and use it to find sin(**θ**), cos(**θ**), or tan(**θ**) given sin(**θ**), cos(**θ**), or tan(**θ**) and the quadrant of the angle. |  |  |  |  |  |  |
| 9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems. |  |  |  |  |  |  |

**Part 3: Rate each Course in the level of expectations for students to be able to apply the Standards for Mathematical Practices.**

**Standards for Mathematical Practice** (SMP) describe the contours of mathematical practice; the various ways in which proficient practitioners of mathematics carry out their work.

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| **N (No)** Students are **Not** expected to learn or apply this practice in this course. | **L (Low)** The course provides opportunities for students to engage in this practice, but does not support consistent engagement in the practice, or does not support growth in the practice. | **M (Moderate)**: The course provides opportunities for students to engage in this practice more than briefly and is an object of discussion or reflection. However, the practice is not used to support students’ learning of concepts or procedures. | **H (High):** The course supports students’ repeated engagement and reflection on this practice. Students use the practice to deepen their learning of concepts and procedures, and to become more proficient in using the practice. |

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| Standard for Mathematical Practice | **Course 1** | **Course 2** | **Course 3** | **Course 4** | **Course 4** | **Course 6** |
| 1. Make sense of problems and persevere in solving them. |  |  |  |  |  |  |
| 2. Reason abstractly and quantitatively. |  |  |  |  |  |  |
| 3. Construct viable arguments and critique the reasoning of others. |  |  |  |  |  |  |
| 4. Model with mathematics. |  |  |  |  |  |  |
| 5. Use appropriate tools strategically. |  |  |  |  |  |  |
| 6. Attend to precision. |  |  |  |  |  |  |
| 7. Look for and make use of structure. |  |  |  |  |  |  |
| 8. Look for and express regularity in repeated reasoning. |  |  |  |  |  |  |

Part IV: What comments and questions do you have?